Session 1 Overview

Plenary Session

Chair: Tim Treadwell, Eastman Kodak, Rochester, NY
ISSCC Executive-Committee Chair

Associate Chair: Jan Sevenhans, AMI Semiconductor, Vilvoorde, Belgium
ISSCC Program-Chair

The Plenary Session commences with the formal opening of the Conference by the Executive-Committee Chair, Tim Tredwell. He is followed by the first of three Plenary presentations. Next, the ISSCC, SSCS, JSSC, and IEEE awards are presented. After a short break, the second and third Plenary presentations are given. All three Plenary presentations support the Conference theme: "Multimedia for a Mobile World". This theme was chosen to highlight this moment in time when semiconductor technology is combining with telecom manufacturing and system-operations to enable global broadband networking, creating the ubiquitous multimedia world, we all take for granted.

In our first Plenary presentation, Tze-Chiang (T.C.) Chen, IBM Fellow, Vice-Preseident of Science and Technology, explores "Where CMOS is Going: Trendy Hype versus Real Technology". His presentation describes the innovations in semiconductor technology to be expected in the next decade, with pronouncements on CMOS' approach towards atomistic and quantum-mechanical boundaries which has led industry pundits to profile nanotechnology, bio-electronics, and quantum computing, as urgently-needed for CMOS replacement. Alternatively, he emphasizes that new materials, coupled with effective circuit design and architectural practices, will ensure at least another 10 years of CMOS service. Furthermore, he warns today's designers of the thrusts of power dissipation and device variability. Such variability must be addressed by design techniques which handle stochastic threshold variation caused by dopant-implant distribution in ultra-small inversion regions which, by the 25nm generation, will give rise to more than 100mV of threshold variation,. At the architectural level, initiatives such as self-healing systems, self-biasing substrates, and simultaneous circuit-and-device diagnostics will extend the circuit's ability to survive and function over a wider range of sensitivities.

In the second Plenary presentation, Herman Eul**,** Senior Vice-President and CEO of Infineon Communications, brings us up-to-date on the subject of "ICs for Mobile Multimedia Communications". In the coming years, problems associated with high-data-rate and mobility trade-offs and different standards (eg. 2G, 3G, Bluetooth, WLAN, GPS and digital video broadcasting), that have led to multimode requirements, and concern for topics such as the coexistence of different technologies, must be solved. Other key considerations for mobile products are energy management and power reduction. In this context, platform concepts that include analog and RF at the most practical cost, power-levels and form-factors, are a key requirement for system-on-chip and system-in-package solutions for current and future mobile multimedia terminals. An important consideration is that at the current growth rate, the number of worldwide subscribers of cellular services is expected to exceed 1.5 billion by 2007. Meanwhile, the demand for higher data rates in a cellular environment drives progress in UMTS mobile systems, in a variety of flavors (WCDMA, CDMA2000, TD-SCDMA). While the deployment of equipment for Release 99/Release4 of WCDMA is far from complete, the first field tests of data rates up to 3.6 MB/s (HSDPA) have already started, and integrated circuits for data rates up to 7.2 MB/s are under development.

In the third Plenary presentation, Ken Kutaragi**,** President and CEO of Sony Computer Entertainment, in his talk "Toward Future Computer Entertainment Systems", brings us a vision of the nature of the computing behind multimedia gaming products, in which "real-timeliness" plays an essential role. There are two aspects of real-timeliness that can be sensed intuitively by a human being: One is the smooth continuity of motion that a human being can cognitively feel to be natural; The other is the immediate response time between action and reaction that human desire and expect. On this basis, in the past, general-purpose computers have proven themselves to be incapable of providing adequate processing power and data-transfer rate for achieving adequate levels of real-timeliness. This deficiency of general-purpose processors has motivated the development of a new breed of more powerful processors built on a new architecture. Today, more than 40 million computer entertainment systems are shipped annually, and computer entertainment is taking a leading role in spearheading advancement of, and demand for, semiconductor technology. In the future, massively "parallel computing over the network", performing vast amounts of computation, as well as "vision systems" that recognize the real world in real-time from a vast number of networked sensors, will revolutionize real-time computing.

1.1 Where CMOS is Going: Trendy Hype vs. Real Technology **8:40 AM**

Tze-Chiang (T.C.) Chen, IBM Fellow, VP of Science and Technology, T.J. Watson Research Center, Yorktown Heights, NY

The development of silicon technology has been, and will continue to be, driven by system needs. Traditionally, these needs have been satisfied by the increase in transistor density and performance, as suggested by 'Moore's Law" and guided by CMOS scaling theory. As the silicon industry moves towards the 45nm node and beyond, the two most important challenges cited are the growing standby power dissipation and the increasing variability in device characteristics. These complaints are cited as the reason Moore's Law is "broken", or why CMOS scaling is coming to an end. Actually, these effects are the embodiments of CMOS technology's approach to atomistic and quantum-mechanical physics boundaries. However, the infusion of new materials and device structures will extend the development lifetime of silicon CMOS by at least ten years. Cooperative circuit/technology co-design, and architectures developed concurrently with these new device innovations will provide a comprehensive solution to the challenges of deep submicron CMOS.

1.2 ICs for Mobile Multimedia Communications **10:15 AM**

Hermann Eul, Member of the Management Board, Infineon Technologies, Munich, Germany

The seemingly never-ending advancement of silicon technology has resulted in the emergence of mobile broadband communication systems for voice, data and video transmission with good connectivity and proper quality-of-service. Devices are being fabricated using processes managed at atomic levels, while IC design involves detailed systems engineering, including the incorporation of application content. Data-rate and mobility tradeoffs and different standards like 2G, 3G, Bluetooth, WLAN, GPS and digital-video broadcasting, are leading to multimode requirements and topics such as the coexistence of different technologies must be solved. Beyond all of that, secure data transfer using security checks like encryption is most important for the networked world.

All of these various topics are, finally, the reason for the appearance of challenging architectural requirements, such as architectural re-configurability and programmability, motivated by the growing importance of multimode and multistandard solutions. While parameters such as data-rate and algorithmic- and circuit-complexity have changed approximately exponentially with time, there has not been much improvement in the battery capacity. For this reason key considerations for mobile products are energy management and power reduction. In this context, the introduction of platform concepts, including analog and RF at the most practical cost, power-levels and form-factors, are key requirements for system-on-chip and system-in-package solutions for current and future mobile multimedia terminals.

This talk will explore current multi-million-transistor ICs with multi-billion operations per second of signal processing, along with analog and RF capabilities for mobile multimedia communications. It will also consider special requirements on wafer processes such as leakage and analog and RF capabilities, and will look at how R&D engineers bridge the world of system-level design, silicon and software. Of course, new challenges going forward will be considered and explored.

1.3 Toward Future Computer Entertainment Systems **11:05 AM**

Ken Kutaragi, President and CEO of SONY Computer Entertainment,Tokyo, Japan

There are two elements in real-timeliness that a human being can intuitively sense. One is the continuity of motion that a human being can cognitively feel to be natural, and the other is response time between action and reaction. Correspondingly, of the applications that have advanced the concept of real-time computing is computer entertainment systems which originally started as computer games. Real-timeliness of computer entertainment systems must be quick enough to match the speed of the response time of the player. Lack of both processing power and data-transfer rate in achieving this level of real-timeliness using general-purpose microprocessors have motivated the development of a new breed of more-powerful processors built on a new architecture.

In computer entertainment systems, since the hardware is normally fixed for several years, once its specifications are determined, there is an inclination to seek the most-advanced technology within the future roadmap, typically that of three years ahead, and one generation ahead in the semiconductor-fabrication process. As a consequence, a system must start off by utilizing large-size chipsets at launch, but, during its life cycle, it goes through two generations of semiconductor fabrication processes for downsizing, as well as progressive integration of chips to reduce manufacturing costs, and to enable mass production. Today, more than 40 million computer entertainment systems are shipped in a year, and are becoming a strong leading power in spearheading advancement in semiconductor technology and in creating demand.

In the future of real-time computing, massive assembly of "Parallel computing over the network" to execute vast amounts of computation, and "Vision System" that recognize the real world, in real-time, from a vast number of sensors over the network, will lead the next era in real-time computing.